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September 2001

FDC6301N
Dual N-Channel , Digital FET

General Description

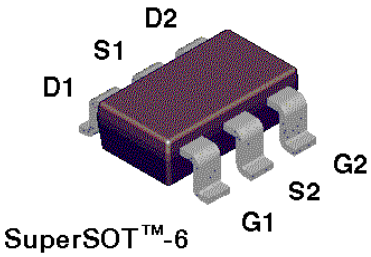
These dual N-Channel logic level enhancement mode field effect transistors are produced using Fairchild 's proprietary, high cell density, DMOS technology. This very high density process is especially tailored to minimize on-state resistance. This device has been designed especially for low voltage applications as a replacement for digital transistors. Since bias resistors are not required, these N-Channel FET's can replace several digital transistors, with a variety of bias resistors.

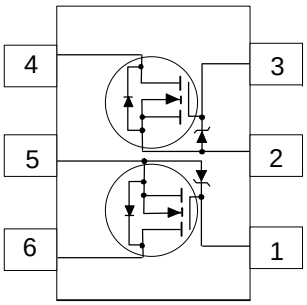
Features

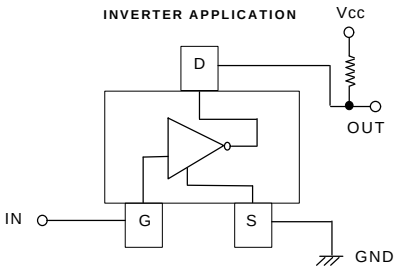
- 25 V, 0.22 A continuous, 0.5 A Peak.
  $R_{DS(ON)}$ = 5 Ω @ V_{GS}= 2.7 V
  $R_{DS(ON)}$ = 4 Ω @ V_{GS}= 4.5 V.
- Very low level gate drive requirements allowing direct operation in 3V circuits. $V_{GS(th)}$ < 1.5V.
- Gate-Source Zener for ESD ruggedness. >6kV Human Body Model.

SOT-23 | SuperSOT™-6 | SuperSOT™-8 | SO-8 | SOT-223 | SOIC-16

Mark: .301







Absolute Maximum Ratings T_A = 25°C unless other wise noted

Symbol	Parameter		FDC6301N	Units
V_{DSS}, V_{CC}	Drain-Source Voltage, Power Supply Voltage		25	V
V_{GSS}, V_{IN}	Gate-Source Voltage, V_{IN}		- 0.5 to +8	V
I_D, I_{OUT}	Drain/Output Current	- Continuous	0.22	A
		- Pulsed	0.5	
P_D	Maximum Power Dissipation	(Note 1a)	0.9	W
		(Note 1b)	0.7	
T_J,T_{STG}	Operating and Storage Temperature Range		-55 to 150	°C
ESD	Electrostatic Discharge Rating MIL-STD-883D Human Body Model (100pf / 1500 Ohm)		6.0	kV
THERMAL CHARACTERISTICS				
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1a)	140	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	(Note 1)	60	°C/W

Electrical Characteristics (T_A = 25 °C unless otherwise noted)

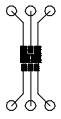
Symbol	Parameter	Conditions	Min	Typ	Max	Units
OFF CHARACTERISTICS						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 µA	25			V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	I_D = 250 µA, Referenced to 25 °C		25		mV /°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 20 V, V_{GS} = 0 V			1	µA
		T_J = 55°C			10	µA
I_{GSS}	Gate - Body Leakage Current	V_{GS} = 8 V, V_{DS} = 0 V			100	nA
ON CHARACTERISTICS (Note 2)						
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold Voltage Temp.Coefficient	I_D = 250 µA, Referenced to 25 °C		-2.1		mV /°C
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 µA	0.65	0.85	1.5	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS} = 2.7 V, I_D = 0.2 A		3.8	5	Ω
		T_J =125°C		6.3	9	
		V_{GS} = 4.5 V, I_D = 0.4 A		3.1	4	
$I_{D(ON)}$	On-State Drain Current	V_{GS} = 2.7 V, V_{DS} = 5 V	0.2			A
g_{FS}	Forward Transconductance	V_{DS} = 5 V, I_D = 0.4 A		0.25		S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 10 V, V_{GS} = 0 V, f = 1.0 MHz		9.5		pF
C_{oss}	Output Capacitance			6		pF
C_{rss}	Reverse Transfer Capacitance			1.3		pF
SWITCHING CHARACTERISTICS (Note 2)						
$t_{D(on)}$	Turn - On Delay Time	V_{DD} = 6 V, I_D = 0.5 A, V_{GS} = 4.5 V, R_{GEN} = 50 Ω		5	10	ns
t_r	Turn - On Rise Time			4.5	10	ns
$t_{D(off)}$	Turn - Off Delay Time			4	8	ns
t_f	Turn - Off Fall Time			3.2	7	ns
Q_g	Total Gate Charge	V_{DS} = 5 V, I_D = 0.2 A, V_{GS} = 4.5 V		0.49	0.7	nC
Q_{gs}	Gate-Source Charge			0.22		nC
Q_{gd}	Gate-Drain Charge			0.07		nC

Inverter Electrical Characteristics (T_A = 25 °C unless otherwise noted)

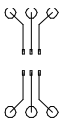
$I_{O(off)}$	Zero Input Voltage Output Current	V_{CC} = 20 V, V_I = 0 V			1	µA
$V_{I(off)}$	Input Voltage	V_{CC} = 5 V, I_O = 10 µA			0.5	V
$V_{I(on)}$		V_O = 0.3 V, I_O = 0.005 A	1			V
$R_{O(on)}$	Output to Ground Resistance	V_I = 2.7 V, I_O = 0.2 A		3.8	5	Ω

Notes:

1. $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design. $R_{\theta JA}$ shown below for single device operation on FR-4 in still air.



a. 140°C/W on a 0.125 in² pad of 2oz copper.



b. 180°C/W on a 0.005 in² of pad of 2oz copper.

2. Pulse Test: Pulse Width ≤ 300µs, Duty Cycle ≤ 2.0%.

Typical Electrical Characteristics

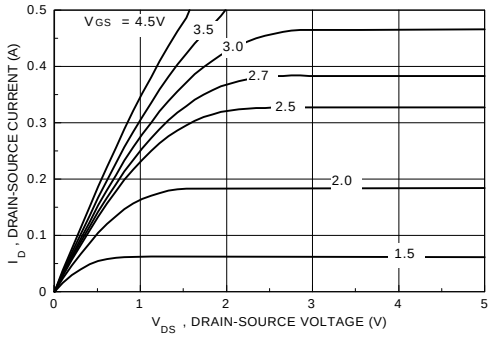


Figure 1. On-Region Characteristics.

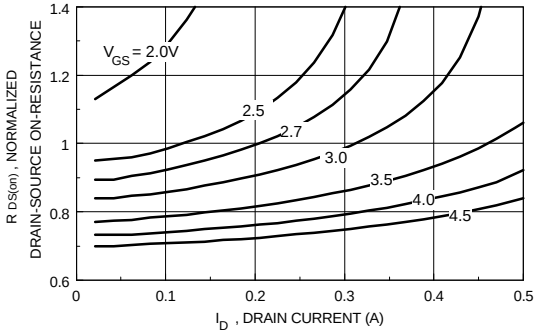


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

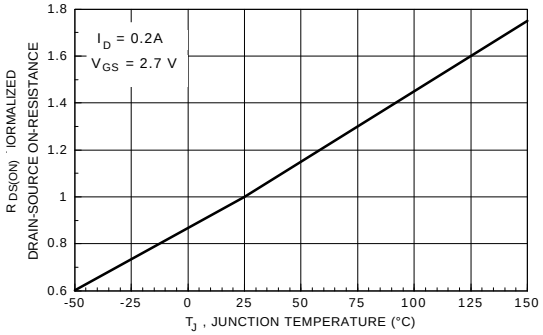


Figure 3. On-Resistance Variation with Temperature.

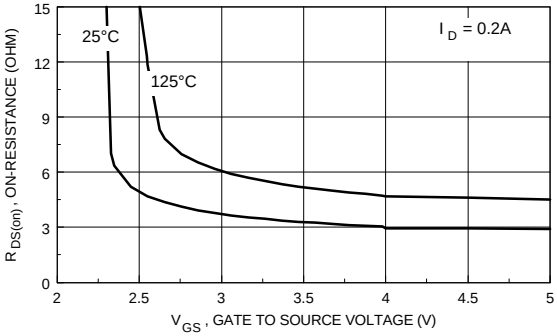


Figure 4. On Resistance Variation with Gate-To- Source Voltage.

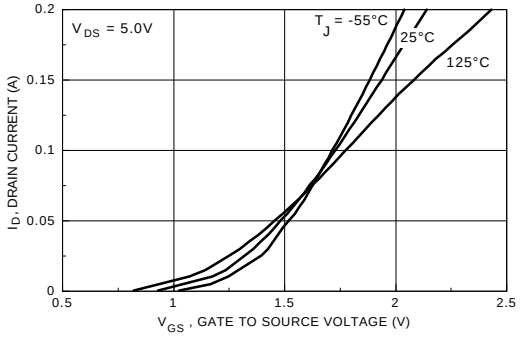


Figure 5. Transfer Characteristics.

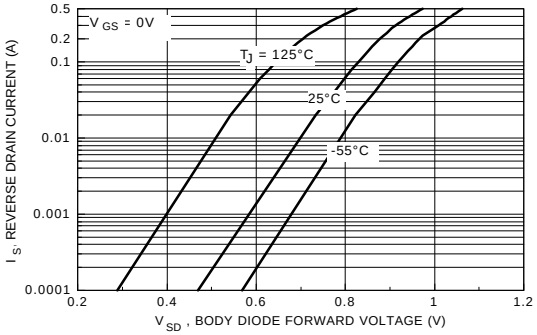


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Electrical Characteristics (continued)

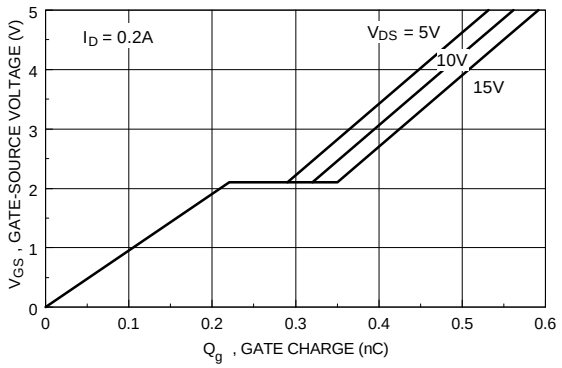


Figure 7. Gate Charge Characteristics.

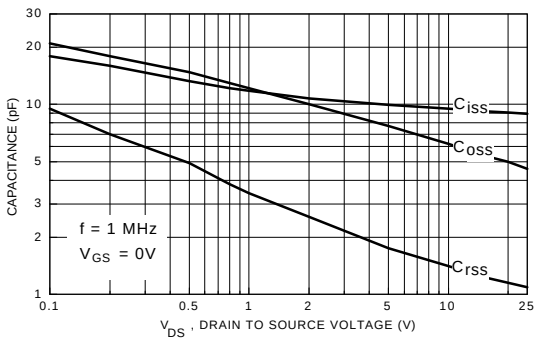


Figure 8. Capacitance Characteristics.

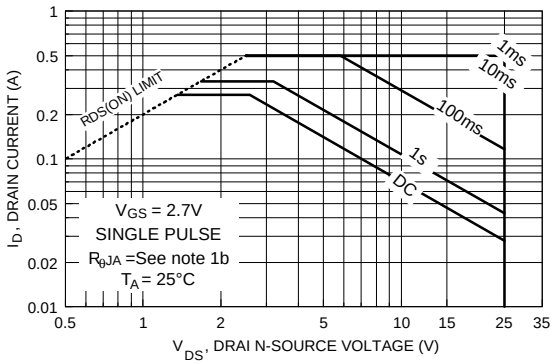


Figure 9. Maximum Safe Operating Area.

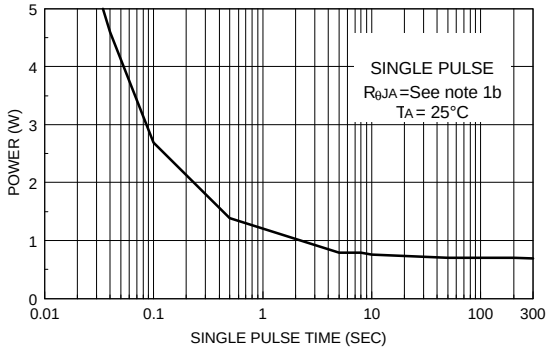


Figure 10. Single Pulse Maximum Power Dissipation.

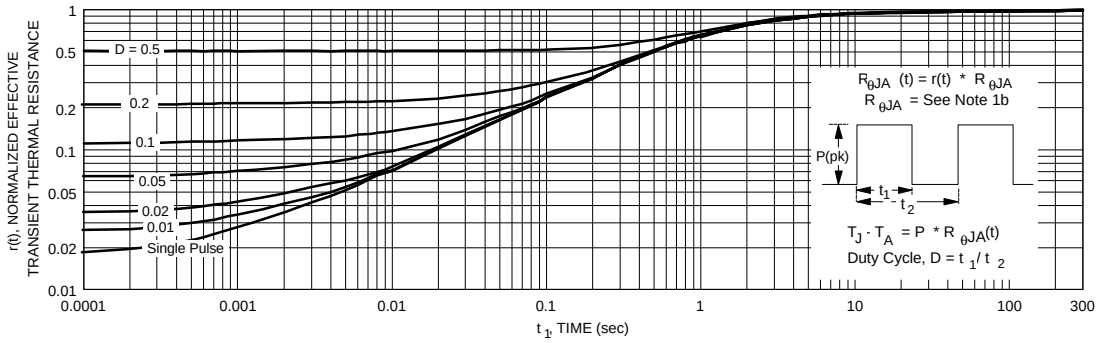


Figure 11. Transient Thermal Response Curve.

Note: Thermal characterization performed using the conditions described in note 1b.Transient thermal response will change depending on the circuit board design.

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